PROPOSED AMENDED CLAIMS - USSN 10/733,696 (Gray)

I claim:

1. [Amended] An internal combustion engine operable in homogenous charge compression ignition mode, comprising:

an engine body with a plurality of combustion cylinders formed therein;

a combustion chamber formed in each combustion cylinder for combustion of a fuel and charge-air mixture;

combustion parameter determining means for determining values of one or more combustion parameters of said combustion, said combustion parameters being related to the nature of said combustion and reflecting changes in said combustion's timing, duration or rates from cycle to cycle;

engine operation control means for adjusting one or more engine operating parameters to change one or more combustion parameter values for subsequent combustion events; and

combustion control parameter control means, programmed to adjust combustion control parameter values responsive to said changes in said combustion parameter values, or in response to said engine operating parameter adjustments, and to limit or counteract changes in said combustion parameter values while one or more engine operating parameters are being adjusted by the engine operation control means.

2. The internal combustion engine of claim 1, wherein the combustion control parameter is fuel quantity.

3. The internal combustion engine of claim 1, wherein the combustion control parameter is intake charge-air temperature.

4. The internal combustion engine of claim 1, wherein the combustion control parameter is intake charge-air oxygen concentration.

5. The internal combustion engine of claim 1, wherein intake charge-air oxygen concentration is one of the engine operating parameters adjusted by the engine operation control means.

6. The internal combustion engine of claim 1, additionally comprising means for recirculation of hot high pressure exhaust gas to increase the intake temperature of the charge-air for combustion.

7. The internal combustion engine of claim 1, wherein the engine operation control means adjusts one or more engine operating parameters individually for each combustion cylinder.

8. The internal combustion engine of claim 7, wherein the intake temperature of the charge-air is determined and adjusted for each combustion cylinder individually.

9. The internal combustion engine of claim 7, wherein the intake pressure of the charge-air is determined and adjusted for each combustion cylinder individually.

10 The internal combustion engine of claim 7, wherein the oxygen concentration of the charge-air is determined and adjusted for each combustion cylinder individually.

11. The internal combustion engine of claim 7, wherein the chamber wall temperature is determined and adjusted for each combustion cylinder individually.

12. The internal combustion engine of claim 11, additionally comprising means for individual cylinder cooling of each combustion cylinder.

13. The internal combustion engine of claim 1, wherein the combustion control parameter control means is additionally programmed to control the combustion control parameter responsive

to an averaged value for said determined combustion parameter(s), to reduce effects of engine combustion variability.

14. The internal combustion engine of claim 13, wherein the number of events averaged to give said averaged value for the determined combustion parameter(s) is a function of the speed, load, or transient conditions of the engine.

15. The internal combustion engine of claim 13, wherein the combustion control parameter control means is additionally programmed so that the combustion control parameter is not changed in response to a change in the averaged value for said determined combustion parameter(s) if the averaged value falls within a specified dead band range.

16. The internal combustion engine of claim 1, wherein said combustion chamber is bounded, in part, by a combustion bowl located in a cooling-controlled area of the combustion chamber.

17. (Amended) A method of operating a multicylinder homogenous charge compression ignition (HCCI) internal combustion engine, comprising:

taking into each of a plurality of combustion chambers in an internal combustion engine a quantity of fuel and a quantity of charge-air;

determining the temperature of the charge-air;

determining the pressure of the charge-air;

determining the oxygen concentration of the charge-air;

combusting a mixture of said fuel and said charge-air;

determining one or more combustion parameters of the combustion of said mixture of fuel and charge-air, said combustion parameters being related to the nature of said combustion and

reflecting changes in said combustion's timing, duration or rates from cycle to cycle;

adjusting one or more of the temperature, the pressure, or the oxygen concentration of charge-air to be taken into said combustion chambers for subsequent combustion events, so that the determined combustion parameter(s) will fall within a targeted range for a given engine speed and load; and

controlling the quantity of fuel used in combustion, responsive to one or more of said determined combustion parameter(s), to offset or limit changes in the combustion parameter(s) during said adjustments to the temperature, the pressure, or the oxygen concentration of the charge-air.

18. The method of claim 17, wherein the intake temperature of the charge-air is determined and adjusted for each combustion chamber individually.

19. The method of claim 18, wherein the intake temperature of the charge-air is adjusted for each combustion chamber through recirculation of hot high pressure exhaust gas.

20. The method of claim 17, wherein the intake pressure of the charge-air is determined and adjusted for each combustion chamber individually.

21. The method of claim 17, wherein the oxygen concentration of the charge-air is determined and adjusted for each combustion chamber individually.

22. The method of claim 17, wherein the chamber wall temperature is determined and adjusted for each combustion chamber individually.

23. The method of claim 22, wherein the chamber wall temperature of each combustion chamber is adjusted by means of individual cylinder cooling.

24. The method of claim 17, additionally comprising controlling the quantity of fuel used

in combustion responsive to an averaged value for said determined combustion parameter(s), to reduce effects of engine combustion variability.

25. The method of claim 24, wherein the number of events averaged for the determined combustion parameter(s) is a function of the speed, load, or transient conditions of the engine.

26. The method of claim 24, wherein the quantity of fuel is not changed in response to a change in the averaged value for said determined combustion parameter(s) if the averaged value falls within a specified dead band range.

27. The method of claim 17, additionally comprising minimizing engine combustion variations by increasing the intake pressure of the charge-air.

28. The method of claim 17, additionally comprising minimizing engine combustion variations by cooling said combustion chambers.

29. The method of claim 28, additionally comprising minimizing engine combustion variations by controlled cooling around a combustion bowl in said combustion chambers.